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Diatoms for a green future

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The world's limited resources impact every level and aspect of decision making today. Recognition of this has catapulted research into optimizing the use of known materials but also finding and exploring new materials, where especially organic or biological materials have created a growing interest. Microalgae represent such a novel material and considering the enormous biodiversity and production upscaling this group of organisms represents one of the most promising sources for new products and applications. Diatoms are a class of unicellular photosynthetic microalgae and among the most common phytoplankton, contributing with approx. 25% to the total primary production of the world equal to that of the rainforests. Diatoms are unique from a biological and photonic point, because of the complex 3D nano-structured silica shell, called the frustule that surrounds the cell, as seen fig. 1A and 1B.

To unlock the photonic application potential of the frustule we have studied the wavelength dependent structural influence of light in the growing phase [1]. We have mapped the wavelength dependent light-frustule interaction, for several species [2, 3]. We have shown how the interference pattern of transmitted light through the frustule can be utilized as an optical switch with a 20 dB extinction ratio, as seen in fig. 1C [2]. Furthermore we have looked at the UV-filtering properties of the frustules.

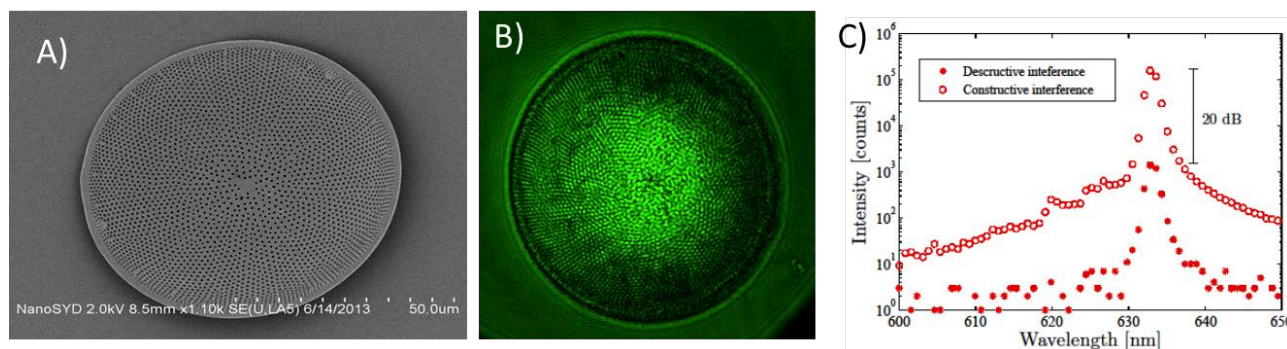


Figure 1: A) SEM image of the nano-structured frustule. B) Optical transmission image through the frustule @532 nm laser. C) Prove of principle of optical switch with 20 dB extinction ratio. Adapted from [1]

[1] Yanyan Su, Nina Lundholm, Søren M. M. Friis, and Marianne Ellegaard, Nano Research, 2015, 8(7): 2363-2372, DOI 10.1007/s12274-015-0746-6

[2] C. Maibohm, S. M. M. Friis, M. Ellegaard and K. Rottwitt, 2015, Vol. 23, No. 7, DOI:10.1364/OE.23.00954, OPTICS EXPRESS 9543

[3] C. Maibohm, S. M. M. Friis, Y. Su, K. Rottwitt, Organic Photonic Materials and Devices XVII, Proc. of SPIE Vol. 9360, 93600B · © 2015 SPIE, doi: 10.1117/12.2078822

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